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Forests in a changing environment

Forests and climate change

Report of the Secretary-General**

Summary

Climate change poses a very serious threat to forests throughout the world and to millions of people who depend on forests to various degrees for their livelihoods, shelter, food and water. The present report examines the impact of climate change on forests and sustainable forest management, addresses the important roles that forests can play in mitigating and adaptation to climate change and identifies possible actions on the part of the United Nations Forum on Forests to that end.

Globally, forest ecosystems in 2005 contained 638 billion tons of carbon, half of it (321 billion tons) in forest biomass and dead wood. The amount of carbon in forests is greater than the amount of carbon currently in the atmosphere. Deforestation and forest degradation are the primary drivers of carbon emissions from forests, accounting for 17.4 per cent of total human-generated carbon dioxide emissions in 2004. Reducing emissions from deforestation and forest degradation, and ensuring the sustainable management and conservation of forests can contribute significantly to mitigating climate change.

Any decision by the secretariat of the United Nations Framework Convention on Climate Change on issues regarding reducing emissions from deforestation and forest degradation may open up new prospects for a funding source for the sustainable management and conservation of forests in the post-2012 Kyoto Protocol commitment period.

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Consideration should be given to closer cooperation between the Forum on Forests and the secretariats of the Framework Convention on Climate Change, the Convention on Biological Diversity and the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, as well as among member organizations of the Collaborative Partnership on Forests, on the role of forests in mitigating and adapting to climate change.

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I. Introduction

1. The non-legally binding instrument on all types of forests, hereinafter referred to as the forest instrument, agreed upon by the United Nations Forum on Forests at its seventh session, was adopted by the General Assembly on 17 December 2007 (see resolution 62/98, annex). In the preambular part of the forest instrument, Member States recognized the impact of climate change on forests and sustainable forest management, as well as the important contributions that forests can make to addressing climate change. At its seventh session, the Forum also adopted the multi-year programme of work for the period 2007-2015, which calls for the eighth session, to be held in 2009, to address the issue of forests in a changing environment, including the themes "forests and climate change", "reversing the loss of forest cover, preventing forest degradation in all types of forests and combating desertification, including in low forest cover countries" and "forests and biodiversity conservation, including protected areas". The present report addresses the first of those interconnected themes, the other two being the focus of separate reports of the Secretary-General. This issue is also of great importance to the member organizations of the Collaborative Partnership on Forests (CPF), which together have prepared a paper for the session entitled "Strategic framework for forests and climate change: a proposal by the Collaborative Partnership on Forests for a coordinated forest-sector response to climate change".

2. Although the issue of forests and climate change was discussed by the Forum's predecessors, the Intergovernmental Panel on Forests (IPF) and the Intergovernmental Forum on Forests (IFF), no proposals for action were agreed upon regarding the issue.[1] With the adoption of the programme of work for the period 2007-2015, the Forum has the opportunity to effectively engage in addressing and supporting the global climate change agenda as it pertains to forests.

3. The present report draws on various sources, including the work of the secretariat of the United Nations Framework Convention on Climate Change, the Intergovernmental Panel on Climate Change and general literature. Contributions from member organizations of the Collaborative Partnership on Forests, particularly the strategic framework, were important in its elaboration. Proposals and recommendations of the Secretary-General are presented in his report on recommendations for addressing key challenges of forests in a changing environment (E/CN.18/2009/8).

II. Forests as a microcosm of sustainable development

4. In addressing the issue of forests and climate change, care must be taken to consider the full scope of forests in sustainable development. Forests provide much more than the carbon sequestration valued in the context of climate change, and it would be a mistake to let that one issue dominate the global forest agenda. If a single good or service among the many covered by sustainable forest management is the subject of a disproportionate focus, including significant financing, there is a

[1] United Nations Forum on Forests secretariat, Subject index and thematic clustering of the IPF/IFF proposals for action, United Nations Forum on Forests resolutions and decisions and relevant Economic and Social Council resolutions, 2007 (*unpublished*).

risk that sustainable forest management could be distorted to the detriment of other goods and services.

5. In the forest instrument, Member States recognized that forests and trees outside forests provide multiple economic, social and environmental benefits and that sustainable forest management contributes significantly to sustainable development and poverty eradication. As is set out, in its statement of purpose, the forest instrument is aimed at enhancing the contribution of forests to the achievement of the internationally agreed development goals, including the Millennium Development Goals, in particular with respect to the eradication of extreme poverty and hunger and environmental sustainability.

6. Forests contribute to the livelihoods of at least 1.6 billion people. Some 60 million people, mainly indigenous communities, live within forests, and another 350 million people are highly dependent on forests. Forest industries, both formal and informal, employ 50 million people. It is estimated that the annual value of international trade in forest products is approximately $270 billion, with 20 per cent corresponding to developing countries. The forest sector continues to grow in economic importance.[2]

7. Forests are critically important for maintaining vital ecosystem functions and the services required for sustainable development, such as the conservation of biodiversity, soil conservation, carbon sequestration, water quality and supply, flood control and climate regulation. It is estimated that at least 80 per cent of the Earth's remaining terrestrial biodiversity is found in forests, which are also a major carbon sink for regulating the global climate (see sect. III below).

8. Given the importance of forests to sustainable development, societal well-being and the provision of key environmental services, climate change poses a very serious threat not only to forests and forest ecosystems but also to millions of people who depend on forests to various degrees for their livelihoods, shelter, food and water.

III. Forests in the climate change equation

9. Anthropogenic greenhouse gas emissions, principally carbon dioxide, are the main causes of climate change, including global warming. Over the past century, there has been an average temperature increase of 0.74°C, and 11 of the 12 years from 1995 to 2006 rank among the 12 warmest years since 1850. Projected increases in the frequency and intensity of storms, floods, heat waves and drought will affect the lives of billions of people worldwide. It has been projected by the Intergovernmental Panel on Climate Change that, if the current trend continues unabated, global temperature will have increased by 1.8 to 4°C by the end of this century, affecting most severely the planet's poorest and most vulnerable and disadvantaged people.[3]

10. According to the Intergovernmental Panel on Climate Change, the largest increase in greenhouse gas emissions in the period from 1970 to 2004 resulted from

[2] World Bank, *Forests Sourcebook* (World Bank, Washington, D.C., 2006).

[3] United Nations Environment Programme, *Global Environment Outlook: Environment for Development (GEO-4), Summary for Decision Makers* (Valletta, 2007), p. 8.

the energy supply, transport and industry sectors, with lower increases for residential and commercial buildings and the forest and agriculture sectors. In 2004, it was estimated that energy supply accounted for 25.9 per cent of all greenhouse gas emissions; industry, for 19.4 per cent; and forests, for 17.4 per cent, owing primarily to deforestation and forest degradation.[4]

11. The parties to the United Nations Framework Convention on Climate Change, in decision 5/CP.13, welcomed the fourth assessment report of the Intergovernmental Panel on Climate Change, recognizing it as the most comprehensive and authoritative assessment on climate change to date. The fourth assessment report addresses options for limiting greenhouse gas emissions and mitigating climate change, and concludes that unmitigated climate change would, in the long term, be likely to exceed the capacity of natural, managed and human systems to adapt. For the lowest mitigation scenario category assessed, emissions would need to peak by 2015, and for the highest, by 2090.[5]

A. Impact of climate change on forests

12. The impact of climate change on forests can be negative or positive, depending on their geographic location. The impact in drylands or lands with lower precipitation rates, particularly in Africa and Asia, of increased temperatures and a drop in rainfall will have far-reaching consequences for forests and the forest-dependent poor, who are already highly vulnerable. In other regions, such as eastern Central America, there have been increases in precipitation, which can be beneficial, although higher temperatures and drought during El Niño episodes can still adversely affect forest ecology.

13. Climate change is having a significant effect on forests through changes in their physiology, structure, species composition and health, largely resulting from changes in temperature and rainfall. Also at risk are the important environmental services that they provide. Of particular concern are the effects that increased temperatures and drought are having on forest health and productivity: more frequent outbreaks of pest infestations, more forest fires and increasing alterations in the populations of plant and animal species.

14. In its fourth assessment report, the Intergovernmental Panel on Climate Change projected that by 2050 increases in temperature and associated decreases in soil water would lead to the gradual replacement of tropical forests by savannahs in eastern Amazonia. Many tropical forests in Latin America will experience a loss in biodiversity.[6] It is projected that by 2030, productivity from forests will have declined over much of southern and eastern Australia and parts of eastern New Zealand as a result of drought and fire.[7]

15. One of the most publicized examples of the effects of climate change is the catastrophic infestation, owing to increased temperatures, of trees in Canada by the mountain pine beetle (*Dendroctonus ponderosae*), which has devastated large

[4] Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report*, available at http://www.ipcc.ch/ipccreports/ar4-syr.htm.

[5] Ibid.

[6] Ibid.

[7] Ibid.

expanses of forests there. In the period from 1997 to 2007, an estimated 13 million hectares, or 130,000 km^2, were destroyed by that pest in western Canada. This destruction is one order of magnitude greater than that caused by any previous outbreak.[8]

16. Global warming due to climate change can also have some positive effects on forest ecosystems, for example by providing longer growing seasons, especially in temperate and boreal regions, leading to faster growth. However, unpredictable changes in composition of flora and fauna and other environmental factors should not be underestimated.

B. Impact of deforestation and forest degradation on climate

17. Carbon, which is stored in large amounts in trees, understory vegetation and forest soils, is the key component of the main greenhouse gas contributing to global warming. Globally, forest ecosystems contained 638 billion tons of carbon in 2005, half of it (321 billion tons) in forest biomass and dead wood. The amount of carbon in forests is greater than the amount of carbon currently in the atmosphere.[9]

18. Deforestation and forest degradation in developing countries are among the primary sources of carbon emissions from forests, as carbon stored in trees and soil is quickly released into the atmosphere by burning forests. In 2004, the forest sector accounted for release of approximately 8.5 billion tons of carbon dioxide, mostly from deforestation, which is equivalent to 17.4 per cent of total human-generated carbon dioxide emissions.[4]

19. In contributing to forest degradation and destruction, climate change is also exacerbating the release of carbon dioxide and further compounding global warming. For example, it is estimated that the cumulative impact of the destruction of forests in western Canada by the mountain pine beetle in the period from 2000 to 2020 as a result of warmer temperatures will be 270 million tons of carbon, an amount equivalent to the reduction in gas emissions by 2012 to which Canada committed itself under the Kyoto Protocol.[10]

IV. Role of forests in responding to climate change

20. Discussion of the role of forests in addressing climate change has been a long and ongoing process. The United Nations Framework Convention on Climate Change, which was adopted in 1992, recognizes the importance of forests as a sink for greenhouse gases. In article 4, paragraph 1 (d) of the Convention, parties commit themselves to promoting sustainable management, and promoting and cooperating in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems.

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[8] Brian Hoyle (2008), "Plight of the pines", *Nature Reports Climate Change*, available at http://www.nature.com/climate/2008/0805/full/climate.2008.35.html.

[9] Food and Agriculture Organization of the United Nations, *Global Forest Resources Assessment 2005*, Forestry Paper 147 (FAO, Rome, 2005), pp. 34 and 35.

[10] W. A. Kurtz and others, "Mountain pine beetle and forest carbon feedback to climate change", *Nature* (24 April 2008), pp. 987-990.

21. Several articles of the Kyoto Protocol, adopted in 1997, including, in particular, article 3, paragraph 3, make provision for the inclusion of land use, land-use change and forestry activities by parties as part of their efforts to implement the Protocol and contribute to the mitigation of climate change. Article 12 of the Protocol defines the clean development mechanism that allows emission-reduction projects in developing countries to earn certified emission reduction credits. Such credits can be traded, sold and used by industrialized countries to meet a part of their emission-reduction targets. It should be noted, however, that, under the clean development mechanism, with regard to forestry, only afforestation and reforestation activities are considered eligible.[11]

22. Despite the provision for the inclusion of afforestation and reforestation projects in the clean development mechanism, owing to various methodological and policy constraints, so far only a negligible number of such projects on forests have been registered.

23. More recently, forests have been receiving greater attention in climate change deliberations, not only because of their role in mitigating and adapting to climate change, but also because of growing concerns about carbon emissions resulting from deforestation and forest degradation in developing countries, where emissions are considerable and increasing. Deforestation and forest degradation are receiving particular attention owing to their significant contribution to global carbon emissions. Deforestation is causing 35 per cent of emissions in developing countries, and in the least developed countries the figure is as high as 65 per cent.[12]

24. The inclusion of the issue of deforestation and forest degradation in developing countries in the context of combating global warming is gaining ground in international negotiations and public discussions. The discussions include various options for public payments and market-based mechanisms to avoid deforestation and degradation.

25. The Bali Action Plan, adopted by the Conference of the Parties to the United Nations Framework Convention on Climate Change in December 2007 (decision 1/CP.13), is a two-year process aimed at finalizing a post-2012 regime for the Kyoto Protocol at the fifteenth session of the Conference of the Parties, to be held in December 2009. The Bali Action Plan established the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention to conduct the long-term cooperative action process, which should be complete by the end of 2009. Issues to be considered include a shared vision for long-term cooperative action, mitigation, adaptation, technology development and transfer, as well as finance. In particular, the Bali Action Plan will address mitigation action by considering policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

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[11] See decision 17/CP.7 of the Conference of the Parties to the United Nations Framework Convention on Climate Change and decisions 3/CMP.1, 5/CMP.1, 6/CMP.1 and 16/CMP.1 of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol.

[12] Food and Agriculture Organization of the United Nations, *State of the World's Forests 2007* (FAO, Rome, 2007), p. 75.

26. To this end, the forest instrument can provide a framework for closer cooperation and collaboration between the Forum on Forest and the Framework Convention on Climate Change. Global objectives on forests 1 and 3 of the forest instrument aim, respectively, to reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation, and to increase significantly the area of protected forests worldwide and other areas of sustainably managed forests, and increase the proportion of forest products from sustainably managed forests. Moreover, the IPF and IFF proposals for action and resolutions of the Forum provide a policy body of work which addresses the drivers of deforestation and forest degradation at the national and international levels that can contribute significantly to reducing emissions from deforestation and forest degradation and that can enhance forest carbon stocks through sustainable forest management.

V. Importance of reducing emissions from deforestation and forest degradation

27. Reducing emissions from deforestation and forest degradation was first addressed as an agenda item at the eleventh session of the Conference of the Parties to the of the United Nations Framework Convention on Climate Change, held in Montreal in 2005. Two years later, the Conference of the Parties adopted the Bali Action Plan. In anticipation of an agreement at the fifteenth session of the Conference of the Parties, a number of activities supported by substantial financial resources have been initiated in pursuit of the objectives relating to reducing emissions from deforestation and forest degradation since the thirteenth session of the Conference of the Parties.

28. In its decision 2/CP.13, entitled "Reducing emissions from deforestation in developing countries: approaches to stimulate action", the Conference of the Parties acknowledged that deforestation and forest degradation result in global anthropogenic greenhouse gas emissions and that such emissions need to be urgently addressed. It also noted that the reduction of emissions from deforestation and forest degradation in developing countries requires stable and predictable resources. It also requested the Subsidiary Body for Scientific and Technological Advice of the Framework Convention on Climate Change to work on methodological issues — including estimating and monitoring changes in forest cover and associated carbon stocks and greenhouse gas emissions — related to a range of policy approaches and incentives for reducing emissions from deforestation and forest degradation in developing countries. At the twenty-ninth session of the Subsidiary Body for Scientific and Technological Advice, held during the fourteenth session of the Conference of the Parties, the Subsidiary Body adopted a number of significant conclusions in this regard.[13] The Subsidiary Body, inter alia,

(a) Requested its Chair to organize an expert meeting to focus on methodological issues relating to reference emission levels for deforestation and forest degradation; the relationship among the reference emission levels and

[13] See FCCC/SBSTA/2008/L.23. In due course, the relevant meeting reports will be available at the website of the United Nations Framework Convention on Climate Change.

relevant reference levels; and the role and contribution of conservation, sustainable management of forests, changes in forest cover and associated carbon stocks and greenhouse gas emissions and the enhancement of forest carbon stocks to enhance action on mitigation of climate change and to the consideration of reference levels;

(b) Recommended methodological guidance noting the importance of, inter alia, promoting the readiness of developing countries, and further mobilization of resources, in relation to decision 2/CP.13, and recognizing the need to promote the full and effective participation of indigenous people and local communities, taking into account national circumstances and noting relevant international agreements;

(c) Recommended taking into account methodological guidance, including, inter alia, the use of the *Revised 1996 IPCC Guidelines for National Greenhouse Inventories*, and encouraging the use of the *Good Practice Guidance for Land Use, Land-use Change and Forestry*, as appropriate;

(d) Requested the secretariat to prepare a technical paper on the cost of implementing methodologies and monitoring systems;

(e) Invited parties and accredited observers to submit, if appropriate, their views on issues relating to indigenous people and local communities for the development and application of methodologies;

(f) Recognized the importance of coordination among parties, organizations and relevant non-governmental organizations, and requested its Chair to explore ways of facilitating the coordination of the activities;

(g) Concluded that guidance from the Ad Hoc Working Group on Long-Term Cooperative Action would facilitate further progress on methodological issues.

29. Accordingly, in order for the initiative to reduce emissions from deforestation and forest degradation to be finalized, further negotiations are needed, including on technical, methodological and policy issues, such as the rights of stakeholders, in particular indigenous peoples, and the opportunity costs of other land uses and forest management systems. There is also a concern that it should not put at a disadvantage those countries that have already taken steps to eliminate or reduce deforestation and to manage their forests sustainably, including through conserving carbon held in forests. Another concern repeatedly expressed by stakeholders is the need for a comprehensive approach to forests and sustainable forest management that goes beyond emission and carbon potentials of forests.

30. Most of the current investment in and financial flows to the forest sector are not directed at addressing climate change, and less than 25 per cent is invested in developing countries and countries with economies in transition. Current financial and investment flows fall far short of what is needed in order for sustainable forest management to contribute to poverty alleviation, sustainable economic growth and the effective protection of critical environmental services in developing countries and countries with economies in transition.[14]

31. Reducing deforestation and forest degradation in the tropics has the biggest mitigation potential in the forest sector. The financial flow required for reducing

[14] United Nations Framework Convention on Climate Change, *Investment and financial flows to address climate change* (Bonn, Germany, 2007), p. 78.

deforestation and forest degradation is estimated as the opportunity cost of converting forests to other land uses, which can differ from one country to another according to the direct drivers (commercial agriculture, subsistence farming and wood extraction).[15] Based on the Global Forest Resources Assessment update (FRA 2005) figure that 12.9 million hectares of forest cover were lost per year in the period from 2000 to 2005, it is estimated that the opportunity cost for reducing emissions from deforestation and forest degradation is $12.2 billion per year. This would result in a reduction of 5.8 billion tons of carbon dioxide emissions by 2030.[16]

32. During the thirteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, held in Bali, the Government of Norway announced its willingness to provide $600 million annually towards efforts to reduce carbon emissions from deforestation and forest degradation in developing countries. The United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP) and the Food and Agriculture Organization of the United Nations (FAO) have established the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries with the short-term aim of working with countries in the development of national strategies to build monitoring, reporting and verification capacity. The Collaborative Programme is expected to provide inputs on experiences gained for negotiations in the context of the Framework Convention on Climate Change, including the negotiation of a new international climate change agreement that takes into account emissions from deforestation and forest degradation, which should be concluded at the fifteenth session of the Conference of the Parties, to be held in Copenhagen in December 2009. The Collaborative Programme is initiating quick-start actions for pilot projects in six developing countries — two each in Africa, Asia and Latin America.[17]

VI. Opportunities and challenges for the forest sector

A. Opportunities

33. Forests provide great opportunities for adaptation to climate change by increasing the resilience of people and ecosystems. They will also be a major mitigation option over the next 30 to 40 years and represent a necessary transitional measure towards a low-carbon economy. However, given the wide range of goods and services provided by forests, mitigation and adaptation options in the forest sector need to be fully understood and used in the context of promoting sustainable development. Moreover, if forests are to effectively contribute to climate change solutions, countries, and the international community as a whole, will need to address several critical governance issues affecting forests, including those relating to rights, tenure, access, land-use planning, benefit-sharing, institutional and cross-sectoral coordination and law enforcement.

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[15] Ibid., pp. 80 and 81.

[16] Ibid., table IV-35, p. 81.

[17] Communication to the Office of the Secretary-General from the Permanent Mission of Norway to the United Nations, 21 July 2008.

34. CPF provides a unique opportunity for a more comprehensive strategic approach to addressing every aspect of sustainable forest management, including those aspects related to climate change. The strategic framework for forests and climate change proposed by CPF provides a strong argument in support of the strategic role that sustainable forest management can play in achieving long-term climate change mitigation and a robust and flexible framework for effective adaptation to climate change.

Key messages of the strategic framework for forests and climate change of the Collaborative Partnership on Forests

The strategic framework for forests and climate change, prepared by the Collaborative Partnership on Forests (CPF) for the eighth session of the Forum on Forests, provides a good foundation for discussing the issue of forests and climate change, including an analysis of mitigation and adaptation. It also addresses the key subject of the monitoring and verification of carbon stock in forests and emissions from deforestation and forest degradation. The framework presents six messages to the international community:

Message 1: Sustainable forest management provides an effective framework for forest-based climate change mitigation and adaptation.

Message 2: Forest-based climate change mitigation and adaptation measures should proceed concurrently.

Message 3: Intersectoral collaboration, economic incentives and the provision of alternative livelihoods are essential for reducing deforestation and forest degradation.

Message 4: Capacity-building and governance reforms are urgently required.

Message 5: Accurate forest monitoring and assessment helps informed decision-making but requires greater coordination at all levels.

Message 6: CPF members are committed to a collaborative and comprehensive approach to forest-based climate change mitigation and adaptation.

35. Several CPF member organizations, including the World Bank, the International Tropical Timber Organization, FAO, UNEP and UNDP, are already mobilizing substantial funds in preparing for and implementing initiatives to reduce emissions from deforestation and forest degradation. At the same time, however, the forest community needs to intensify its efforts to coordinate activities to address gaps and identify solutions. In this context, closer collaboration and cooperation between the Forum on Forests and CPF members would be desirable.

B. Constraints and challenges

36. The issue of forests and climate change is complicated and requires closer collaboration among leading players. For example, at its twenty-ninth session, the Subsidiary Body for Scientific and Technological Advice emphasized the need for further coordination of activities among parties, organizations and civil society. As the CPF strategic framework makes clear, intersectoral collaboration, economic incentives and the provision of alternative livelihoods are essential for reducing deforestation and forest degradation.

37. Opportunities for synergies in the context of reduction of emissions from deforestation and forest degradation should be explored with a view to reinforcing the implementation of mitigation measures aimed at achieving such reductions and the promotion of sustainable forest management in developing countries (see E/CN.18/2008/2, sect. V).

38. One principal concern is the fact that, when one single good or service, among the many covered by sustainable forest management, attracts significant finance, there is a risk that it can distort or skew the goals of sustainable forest management to the detriment of other goods and services.

39. The development of a mechanism for reduction of emissions from deforestation and forest degradation must be based on sound methodologies for estimating and monitoring changes in forest cover and associated carbon stocks and greenhouse gas emissions, incremental changes owing to the sustainable management of forests, and reductions in emissions resulting from deforestation and forest degradation. The methodological challenges involved have proved to be much more complicated for forest degradation than for deforestation. A workshop organized by the secretariat of the Framework Convention on Climate Change on methodological issues related to reduction of emissions from deforestation and forest degradation in developing countries, held in Tokyo in 2008, concluded that addressing the issue of emissions from forest degradation was more difficult than addressing the issue of emissions from deforestation. It was also noted that there are different types of forest degradation, and some may be easier to measure than others (FCCC/SBSTA/2008/11, para. 46).

40. Many developing countries would need extensive capacity-building and training activities on monitoring, reporting and verification in order to be able to effectively apply the methodologies for estimating and monitoring carbon emissions from deforestation and forest degradation. Such an undertaking would require adequate financial resources. In addition, capacity-building, institutional development and training are needed for those countries not able to meet even the minimum requirements for sustainable forest management in the context of the objectives of the initiative, and even for those that are closer to achieving the capacity to incorporate monitoring, reporting and verification into their national processes.

41. The issue of forests and climate change affects a wide range of stakeholders, who need to be taken into account. The Forest Dialogue has brought many of those stakeholders together, and, in 2008, in a joint statement entitled "Beyond REDD: the role of forests in climate change", they expressed their concern that the implementation of measures for forest-related climate change mitigation and adaptation provides not only opportunities, but also risks for indigenous peoples and

other marginalized groups. Five principles were listed that should be considered in guiding post-2012 arrangements on climate change:

(a) Ensuring that forest-related climate change options support sustainable development in both forest-rich and forest-poor countries;

(b) Tackling the drivers of deforestation that lie outside the forest sector;

(c) Supporting transparent, inclusive and accountable forest governance;

(d) Encouraging local processes to clarify and strengthen tenure, property and carbon rights, giving full recognition to indigenous peoples, small-forest owners, the forest workplace and local communities;

(e) Providing substantial additional funding to build the capacity to put the above principles in practice.

C. Promoting climate change mitigation and adaptation strategies in national forest programmes

42. If mitigation and adaptation options in the forest sector are to be successful, they need to be fully understood and used in the context of promoting sustainable development.[18] Mitigation and adaptation strategies in response to climate change will need to be developed and integrated into national forest programmes and, in turn, into national development strategies. Innovative and emerging solutions are required, supported by economic policy instruments and public and private sector investment in sustainable forest management technologies and carbon sequestration approaches — many of which are already being used. The Forum on Forests, with the support of the Collaborative Partnership on Forests, could contribute to such a process.

43. The Intergovernmental Panel on Climate Change defines mitigation as "An anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks".[19] Mitigation measures for reducing emissions from deforestation and forest degradation in the forest sector are promising. The Panel has identified a number of available technologies and practices: afforestation; reforestation; forest management; reduced deforestation; harvested wood production management; use of forest products for bioenergy and to replace fossil fuels; tree species improvement to increase biomass production and carbon sequestration; improved remote-sensing technologies for analysis of vegetation/soil carbon sequestration potential; and the mapping of land-use change.

44. The policy measures required are financial incentives to increase forest area, reduce deforestation, rehabilitate degraded forests, maintain and sustainably manage forests; and land-use regulation and enforcement. Such policies and corresponding mitigation measures would contribute to poverty alleviation.[4]

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[18] J. Blaser and C. Robledo, "Not for timber alone — the role of forests in climate change", presentation made at Washington, D.C., 2008.

[19] Intergovernmental Panel on Climate Change, *Climate Change 2007: Impacts, Adaptation and Vulnerability*, contribution of Working Group II to the fourth assessment report, 2007, appendix I.

45. Adaptation is defined by the Intergovernmental Panel as "Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects".[20] Adaptation is divided into three principal types: anticipatory adaptation, which refers to actions taken before the impacts of climate change are observed; autonomous adaptation, also known as spontaneous adaptation, which is not a conscious response but one that is prompted by ecological changes in natural systems or in human systems; and planned adaptation, which is the product of deliberate policy decisions, based on an awareness of changing conditions and that actions are required to return to, maintain or reach a desired state.[19] While mitigation measures aim to fix and maintain carbon, adaptation seeks to increase the resilience of people and ecosystems.[18]

46. According to the Intergovernmental Panel, key vulnerabilities exist in the short term in the form of drought, insects and fire. Models used by the Panel indicate that there will be significant forest dieback towards the end of this century and beyond in tropical, boreal and mountain areas, accompanied by the loss of key services. Losses of biodiversity are projected, particularly in tropical forest diversity hot spots such as north-eastern Amazonia and tropical Africa. Mountain forests are being affected, with a loss of high-altitude habitats.

47. Adaptation practices fall into three different temporal categories: responses to current variability, which can take advantage of lessons learned from past adaptations; responses to observed medium- and long-term climate trends; and anticipatory planning in response to model-based scenarios of long-term climate change.[21] Most practices in the forest sector fall under the first category and include:

(a) Season climate forecasting, as in the case of El Niño-Southern Oscillation;

(b) Disease surveillance systems;

(c) Regulation and rationing of the usage of water provided by forests;

(d) Strategies for drought and coastal management;

(e) Strategies for preventing and combating forest fires, including the construction of fire lines and controlled burning;

(f) Reforestation of mangroves;

(g) Utilization of drought and fire-resistant tree species, such as teak, in tropical forest plantations;

(h) Establishment of biological reserves and ecological corridors for protecting ecosystems from the impact of climate change;

(i) Compensation paid to forest owners for environmental services provided by those forests to society.

48. Adaptive capacity — the ability or potential of a system to respond successfully to climate change — is a prerequisite for the design and

[20] Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report*, annex II, available at http://www.ipcc.ch/ipccreports/ar4-syr.htm.

[21] Intergovernmental Panel on Climate Change, *Climate Change 2007: Impacts, Adaptation and Vulnerability*, chap. 17.2.

implementation of effective adaptation strategies. For most developing countries, capacity-building and technology transfer will be required. Successful adaptation to climate change is complex and can be difficult. Policy and planning processes need to take into account the fact that capacities for adaptation and the processes by which it occurs differ greatly within and across regions, countries, sectors and communities. Adaptation can be limited by the extent and rate of climate change, as well as by technological limitations, financial barriers, informational and cognitive barriers and social and cultural barriers. In most cases, adaptation is undertaken as part of broader social and development initiatives.[22]

49. Much of the focus on adaptation to climate change has been in the areas of energy demand, sea-level rise and coastal protection, water management, agriculture and infrastructure. Less attention has been paid to the forest sector. However, at its eighth session, the Forum on Forests will be afforded the opportunity to address this important issue in depth for the first time. Through the CPF global forest expert panel (formerly the joint initiative on science and technology), led by the International Union of Forest Research Organizations, with the participation of FAO, UNEP, the secretariat of the Convention on Biological Diversity, the Centre for International Forestry Research, the World Agroforestry Centre and the Forum secretariat, and following consultations during the seventh session of the Forum in 2007 and the twelfth session of the Subsidiary Body for Scientific, Technical and Technological Advice of the Convention on Biological Diversity, also in 2007, an expert panel on adaptation of forests to climate change has been established. The task of the expert panel is to assess the state of knowledge on the adaptation of forests and forest-dependent people to climate change. The assessment report, which includes current information about environmental and socio-economic impacts and vulnerabilities, as well as policy and management options for adaptation, has been prepared as a contribution to the discussion at the eighth session of the Forum under the agenda item "Forests in a changing environment", specifically under the sub-item "Forests and climate change".[23]

VII. Conclusions

50. **There is increasing evidence that climate change is seriously affecting forests throughout the world. Boreal, temperate, subtropical and tropical forests, including mangroves, are at risk throughout the world.**

51. **Forests are important for sustainable development, societal well-being and the provision of key environmental services. Climate change imposes additional stresses on millions of people on the Earth who depend on forests to different degrees for their livelihoods, shelter, food and water and, in particular, on the forest-dependent poor, who are already highly vulnerable.**

52. **Carbon, thought to be a leading element contributing to global warming, is stored in large amounts in forest ecosystems, which in 2005 were estimated to contain 638 billion tons of carbon. The amount of carbon in forests is greater than the amount of carbon currently in the atmosphere.**

[22] Ibid., chap 17.4.

[23] See www.iufro.org/publications/view/article/2008/policies-and-instruments-for-the-adaptation-of-forests-and-the-forest-sector-to-impacts-of-climate-c/.

53. **Deforestation and forest degradation are the primary drivers of carbon emissions from forests, accounting in 2004 for 17.4 per cent of total human-generated carbon dioxide emissions.**

54. **By contributing to forest degradation and deforestation, climate change is also exacerbating the release of carbon dioxide and further compounding global warming.**

55. **Although forests can play an important role in addressing climate change, agreement on that role has been a continuing process in the negotiations and implementation of the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Forests have great potential to contribute to the overall climate change strategy.**

56. **More recently, the issue of forests has been receiving attention in climate change negotiations, in particular with respect to the need for reductions in developing countries' emissions resulting from deforestation and forest degradation, which account for 35 per cent of emissions in developing countries and 65 per cent in the least developed countries.**

57. **The Bali Action Plan noted the importance of forests in mitigating and adapting to climate change. The fifteenth session of the Conference of the Parties to the Framework Convention on Climate Change, to be held in 2009, is expected to reach agreement on issues relating to reducing emissions from deforestation and forest degradation in developing countries, which will have a long-term impact on forest management and financial flows to forests in the future.**

58. **In addressing the issue of forests and climate change, care must be taken to consider the full scope of forests in sustainable development. Forests provide much more than the carbon sequestration valued in the context of climate change, and care should be taken so that that one issue does not dominate the global forest agenda.**

59. **The best opportunity for the Forum on Forests and its member States to contribute to the global climate change agenda appears to be through the promotion of sustainable forest management, including mitigation and adaptation measures related to climate change. Sustainable forest management can also contribute to addressing other environmental, social and economic challenges. In this context, the outcome of the negotiations under the Forum on financing sustainable forest management could contribute substantively to the ongoing climate change negotiations.**

60. **The Collaborative Partnership on Forests provides a unique opportunity for a more comprehensive strategic approach to addressing every aspect of sustainable forest management, including those aspects related to climate change.**